



BREATHING LUNG TRANSPLANTATION” - A ROAD TO RELIEF NEW LUNGS WITH OLD VESSELS

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ABSTRACT

A lung transplant is a surgery to replace diseased lungs with healthy lungs. The discipline of lung transplant has made extraordinary innovative over the last decades. Although advances, morbidity and mortality also high when compared with other solid organ transplants. Lung transplantation is a life-saving treatment for patients with advanced lung diseases of various nonmalignant etiologies. A lung transplant is a surgical procedure to replace an infected lung with healthy lung. Lung transplantation is a regenerate cure for patients with cessation stage lung disease; however, it is rarely about patient with acute respiratory distress syndrome (ARDS) assign to infectious causes. Faulty lungs can make it bother for the body to get the oxygen it needs to pull through. The severe acute respiratory syndrome coronavirus 2 pandemic create challenges for lung transplant recipients. A diversity of diseases can damage your lungs and keep them from functioning effectively. Bank on patient's medical condition, a lung transplant may involve replacing one of the subject's lungs or both of them. In some situations, the lungs may be transplanted along with a donor heart.

KEYWORDS: Lung transplantation; complications; mortality; Heart–lung transplantation (HLT), patient selection, COVID-19; SARS-CoV-2.

INTRODUCTION:

In 1999, Dr. KM Cherian performed the first double-lung transplantation (DLT) and the first combined heart–lung transplantation (HLT) in India, thereby ushering in the beginning of the era of LT in India (1).

Following this initial enthusiasm, there was a decline in LT activity, until 2007, when a combined HLT was performed at Apollo Hospitals, Chennai (2)

In 2011, single lung transplantation (SLT) was first performed in in Global Hospitals in Chennai (3)

The first SLT in state of Maharashtra was done in Hinduja Hospital, Mumbai, on 11 July 2012 (4)

The first SLT in the state of Andhra Pradesh (now Telangana) was performed in Yashoda Hospital in September 2012 (5)

The first combined HLT was performed in Mahatma Gandhi Hospital, Jaipur, on 5 December 2016 (6)

The first combined HLT was performed in Lissie Hospital, Kochi, in 6 January 2017 (7)

The first DLT and the first combined HLT were done in Narayana Hrudayala Hospital, Bengaluru, on 20 June 2018, and 3 Jan 2019 (8,9)

In India, the first LT for COVID-affected lungs was performed on 24 August 2020 in the city of Hyderabad, Telangana. In Tamil Nadu, the first LT for COVID-affected lungs was performed on 27 August 2020 (10,11)

This was followed by a LT for COVID-affected lungs in Delhi, which also happened to be the first LT to be done in New Delhi (12)

Lung transplantation nowadays is a well-accepted and routine treatment for well selected patients with terminal respiratory disease.(13)

While lung transplants carry certain associated risks, they can also extend life expectancy and enhance the quality of life for those with end stage pulmonary disease (14)

Although sporadic cases of lung transplantation for COVID-19-associated acute respiratory distress syndrome (ARDS) have been reported (15,16,17)

Their heart rate responds less quickly to exertion due to the cutting of the vagus nerve that would normally help regulate it (18)

Respiratory diseases impose enormous health burdens worldwide, not least disability and early death.(19,20)

HISTORY:

Vladimir Demikhov and Henry Metras, during the 1940s and 1950s, first demonstrated that the procedure was technically feasible.

James Hardy of the University of Mississippi performed the first human lung transplant on June 11, 1963 (21,22)

Following a single-lung transplantation, the patient, identified later as convicted murderer John Richard Russell survived for 18 days (23)

The first successful transplant surgery involving the lungs was a heart-lung transplant, performed by Dr. Bruce Reitz of Stanford University in 1981 on a woman who had idiopathic pulmonary hypertension (24,25)

1983: First successful long-term single lung transplant (Tom Hall) by Joel Cooper (Toronto) (26)

1986: First successful long-term double lung transplant (Ann Harrison) by Joel D. Cooper (Toronto) (27)

1988: First successful long-term double lung transplant for cystic fibrosis by Joel Cooper (Toronto).

In 1988, Vera Dwyer, a woman from County Sligo in Ireland, was diagnosed with an irreversible, chronic and fibrotic lung disease. Later on that year, she received a single lung transplant in the UK. In November 2018, Ms. Dwyer was recognized as the world's longest surviving single lung transplant recipient in an event at the Mater Hospital in Dublin (28,29)

Road to relief:

India's first ever breathing lung transplant was performed in middle aged man with end stage interstitial lung disease. This runs the lungs through a device that cools the organ while it breaths, nourishes it with a substrate enriched solution that will wipe out traces of infection.

Selection of recipient:

The selection of appropriate recipients for lung transplantation is an evolving discipline. (30)

Bronchiolitis obliterans syndrome (BOS) is the most common form of chronic lung transplant rejection.

Selection of donor:

1. Donors should be within 18 to 64 years old.
2. Sex may pass on accomplishment to all female recipients especially in male to female transplants.
3. Female donors to male recipients may produce negative outcomes
4. Race matched donors have improved outcomes
5. African American donors express unsatisfactory projection
6. Smoking donors may decrease recipient survival post-transplant
7. Chest radiographs are a poor indicator of lung donor function
8. Brain dead donors and deceased donors have identical diagnosis
9. Although there have been multiple trials on individual lung donor criteria that fail to show negative recipient prognosis, there are few studies that evaluate the effects of multiple extended criteria compounded together in one donor lung.(31)

These compromises in physiology may have untold effects on primary graft dysfunction (PGD) and overall patient mortality (32)

“Bridge to lung transplantation”

It refers to strategies to manage with artificial support the acutely decompensating patient until a suitable organ is available (33).

Mechanical ventilation today has been the most commonly used bridging strategy to lung transplant, but ventilated patients are particularly susceptible to ventilator-induced lung injury and ventilator-associated pneumonia and requires patients to be bed-bound and often sedated, which reduces their ability to undergo adequate physiotherapy. (34)

Since the beginning of the lung transplant era, ECLS has been recognized as a potential bridge to lung transplant for patients with respiratory failure. However, the initial clinical experience in the 1980's and 1990's was discouraging with a high mortality rate and a high incidence of complications associated with the application of ECLS (35)

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West Bengal's first lung transplantation takes place

The recipient, who developed complications following recovery from Covid-19, is on ECMO support as both of his lungs were completely damaged. West Bengal on Tuesday witnessed its first lung transplantation after doctors at a private hospital in Kolkata successfully conducted a marathon surgery to give an IT professional a new lease of life, an official of the medical establishment said.

**One-year-old undergoes bilateral lung transplant
Boy had Broncho pulmonary dysplasia**

MGM Healthcare doctors have performed a bilateral lung transplant on a one-year-old boy from Chennai, who suffered from broncho pulmonary dysplasia, a chronic lung disease affecting newborns.

**Man undergoes bilateral lung transplant
Punjab farmer was diagnosed with interstitial lung disease**

A 34-year-old man from Chandigarh, with a low body mass index, recently underwent lung transplant surgery at a city hospital here. The farmer from Punjab had a rare familial interstitial lung disease. ILD is a group of disorders that progressively scars lung tissue. It is believed to occur in one in one lakh population.

Breathing lung transplantation performed

A breathing lung transplantation was performed by doctors at the Krishna Institute of Medical Sciences (KIMS), Secunderabad, on Saturday. Doctors claimed that this was the first such procedure conducted in India. The surgery was performed by director of the Lung Transplant programme Dr. Sandeep Attawar and his team on a middle aged patient with end stage interstitial lung disease with 10

litres of oxygen support.

Yashoda, CMRI launch of lung transplant programme

Yashoda Hospitals-Hyderabad and CMRI-Kolkata have taken an initiative to work together in providing Heart and Lung Transplantation Services, ECMO and Thoracic surgeries. A memorandum of understanding (MOU) on this was signed between the two institutions.

AIIMS second public hospital in India to do lung transplant

AIIMS has become only the second public hospital in the country to conduct a lung transplant procedure after PGIMER, Chandigarh. The surgery involves removing one or both diseased lungs from a patient and their replacement by a healthy one from a cadaver donor

Murali Manoharan, the donor, a soldier in the Indian Army, was declared brain dead at the Army (Research and Referral) Hospital after a road traffic accident, according to vice admiral Rajat Datta, director general, Armed Forces Medical Services. “Manoharan's wife, Kaushalya, consented to the donation. Lungs were used for the transplant at AIIMS. Group captain Sumesh Kaistha of the Army hospital said that this was the first time they retrieved the lungs from a brain-dead donor. She was on non-invasive ventilator support for almost two years,” said Kaistha.(37)

Man with lungs damaged by COVID undergoes transplant after donor organs brought from Ahmedabad

A 55-year-old patient is a resident of Meerut in Uttar Pradesh, was suffering from chronic obstructive pulmonary disease (COPD). His lungs had been damaged due to the coronavirus. He underwent a bilateral lung transplant at a private facility here after donor organs were transported 950 kilometres in three hours, according to a statement. The surgery took place at Max Hospital, Saket, and the hospital said it is the first time in North India that a bilateral lung transplant has been done with the help of extracorporeal membrane oxygenation, (ECMO) support. At the hospital, he was evaluated by a heart lung transplant team led by Dr Rahul Chandra, the statement said.(38)

Extremely rare' double lung transplant saves Chicago man with terminal cancer

Albert Khoury, 54, underwent a seven-hour surgery to receive his new lungs at Northwestern Medicine in Chicago on September 25, 2021. Albert Khoury - a 54-year-old non-smoker with terminal lung cancer - underwent a seven-hour surgery to receive his new lungs in September 2021. Six months on, the lungs are working well and he has no signs of cancer in his body. The surgery, performed at Northwestern Medicine in Chicago, gives hope to others who have advanced stages of lung cancer. Ankit Bharat, chief of thoracic surgery at Northwestern Medicine, said the 'extremely uncommon' surgery is 'considered a complete "no-go" for terminal lung cancer patients (39)

Family of unvaccinated Georgia man, 24, who underwent DOUBLE LUNG transplant after contracting COVID-19 says he regrets not getting a shot. Blake Bargatz, 24, from Sugar Hill, Georgia, did not get a COVID-19 vaccine because he feared side effects. His lungs became so damaged that he needed a double lung transplant. He received his new pair of lungs on June 28 and now faces six to eight months of recovery and rehabilitation

Contraindications:

1. Lung transplantation should not be offered to adults with a recent history of hematologic malignancy, sarcoma, melanoma, or cancers of the breast, bladder, or kidney.
2. Defective of another major organ system (e.g., heart, liver, kidney or brain)
3. Faulty coronary artery disease
4. Inconstant medical conditions like acute sepsis, myocardial infarction, and liver failure;
5. Bleeding disorder;
6. Mycobacterium tuberculosis infection;
7. Psychiatric or psychological issues
8. Drug abuse

Laboratory Studies

The common laboratory tests are

1. HIV, hepatitis B, hepatitis C,
2. toxoplasmosis,
3. cytomegalovirus (CMV)
4. Epstein-Barr virus (EBV)

Serological tests

1. Liver function tests
2. Creatinine and creatinine clearance tests
3. Blood count
4. Complete blood Chemistry
5. Human leukocyte antigen (HLA)
6. phenotype and panel-reactive antibody (PRA) level
7. Room air blood gas
8. Coagulation profile

Radiographic techniques

1. Chest computed tomographic (CT) scan
2. Echocardiogram Right and left heart catheterization
3. Quantitative lung perfusion scan
4. Mammogram
5. Pap smear/prostate-specific antigen (PSA) assay
6. Colonoscopy
7. Bone density study
8. Pulmonary function tests with a 6-min walk
9. Bronchoscopy

Complications from lung transplantation are

Bleeding, Infection, Blockage of the blood vessels to the new lung(s), Blockage of the airways, Severe pulmonary edema (fluid in the lung) and Blood clots.

Primary Graft Dysfunction

Primary graft dysfunction (PGD) describes a form of acute allograft injury characterized by development of noncardiogenic pulmonary edema within 72 hours of transplantation in the absence of identifiable secondary causes (40)

Airway Complications Lung transplantation is unique among solid organ procedures in that no attempt is routinely made to reestablish systemic blood flow to the allograft, in this case via the bronchial arterial circulation.

Dhillon and colleagues recently demonstrated by computed tomography (CT) angiography that bronchial arteries often fail to regrow distal to the bronchial anastomosis and that bronchial mucosal oxygen saturation measured distal to the anastomosis is significantly lower than that recorded in the native airways (41)

Infection

Infection is an ever-present threat to the lung transplant recipient and a leading cause of both early and late deaths. Lung transplantation has become a successful treatment option for end-stage diseases of the lungs and the pulmonary circulation. Infections still are the most common cause of early and late morbidity and mortality in lung transplant recipients. Bacterial infections comprise approximately half of all infectious complications. Bacterial pneumonia is by far the most frequently encountered infection, with a peak incidence in the first post-transplant month (42)

Three-quarters of all bacterial pneumonias are caused by *Pseudomonas* species and *Enterobacteriaceae* (43)

Bacterial pneumonias are primarily by *Staphylococcus aureus*, *Enterococcus* species, and *Hemophilus influenzae*. Infections by *Mycobacterium tuberculosis* are occasionally reported (44)

Lung transplant recipients are at increased risk of candidemia, especially in the early post-transplant period.

Diagnosis of pulmonary aspergillosis can be problematic. The relatively high prevalence of airways colonization in lung transplant recipients can make it difficult to interpret the significance of positive fungal stains and cultures derived from BAL specimens. (45)

Performance characteristics of the galactomannan assay have not been fully established in the lung transplant population but preliminary experience suggests an unacceptably low sensitivity for both serum and BAL, though specificity appears to be high (46,47).

Cytomegalovirus (CMV) is the most common viral pathogen encountered after lung transplantation.

Numerous prospective, randomized trials have documented the efficacy of antiviral prophylaxis in reducing the incidence and severity of CMV disease in transplant recipients (48).

Oral valganciclovir has largely replaced intravenous ganciclovir as the prophylactic agent of choice, due to its excellent bioavailability, ease of administration, and demonstrated efficacy (49).

Universal prophylaxis of all donor-seropositive/recipient-seronegative patients

is recommended because the risk of CMV disease is high (50).

About one-third of the infections with *P. carinii* may occur after the first postoperative year (51)

Toxoplasma gondii pneumonitis has been described exclusively in heart-lung recipients (52)

SUMMARY:

Lung transplantation is the only paradigm that endeavor a everlasting resolution for end-stage lung diseases. A few hospitals are doing vigorous lung transplantations. Preoperative and postoperative considerations in lung transplantation may be different in the developing countries when compared to the developed world. (53)

CONCLUSION:

Blemished lungs can make it difficult for to get the oxygen it needs to survive. A diversity of diseases damage lungs. Chronic obstructive pulmonary disease (COPD), including emphysema, Scarring of the lungs (pulmonary fibrosis), Cystic fibrosis and High blood pressure in the lungs (pulmonary hypertension) forced to obstruct exchange of air and produce air hunger. Lung damage can often be treated with medicines and breathing devices. But when these programs are out of hand lung function becomes life-threatening, doctors suggest a single-lung transplant or a double-lung transplant.

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